National Aeronautics and Space Administration

X-press

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Explore.Discover.Understand.

EC05 0030-07 NASA Photo by Jim Ross

Dryden's F-15B test fixture recently was used in the Lifting Insulating Foam Trajectory experiment as part of NASA's return-to-flight work. The LIFT experiment tested behavior of insulating foam debris when it is shed from the Shuttle's external fuel tank.

F-15B gives a LIFT

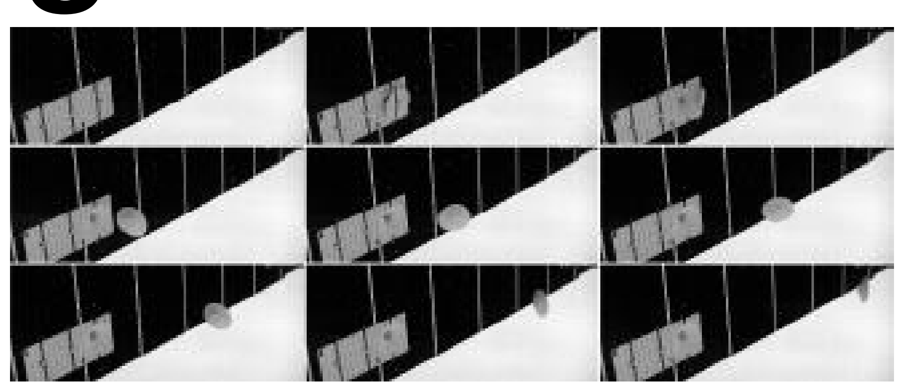
■ Space Shuttle return-to-flight effort benefits from project work at Dryden

By Gray Creech
Dryden Public Affairs

As part of the Agency's return-to-flight effort, NASA engineers are acquiring data on how insulating foam debris or "divots" behave when these small pieces are shed from the Shuttle's external fuel tank during launch.

Dryden conducted a series of flight tests of the divots as part of the return-to-flight team effort. The Lifting Insulating Foam Trajectory flight test series at Dryden used the Center's F-15B research testbed aircraft to test the divots in a real flight environment at speeds up to about Mach 2, or twice the speed of sound.

Small-scale divoting occurs when adhesive on the external tank thermal protection system, or TPS, foam fails. This occurs as a result of decreasing atmospheric pressure combined with increased heating during Shuttle ascent, which causes air trapped beneath the TPS to expand.



NASA Photo

Dryden engineer Kendall Mauldin pieced together these frame captures obtained using a high-speed camera during a March 16 flight. The image shows a foam divot (the round object seen in the third and fourth rows from top) ejected from the F-15B test fixture at Mach 1.97 and 47,000 feet in the LIFT experiment.

Nine divot ejection flights using BX-265 shuttle external tank foam were successsfully flown in the F-15B LIFT project. A total of 38 divots were ejected in these flights at subsonic and supersonic test points along the Shuttle's ascent trajectory, up to Mach 2 and a maximum dynamic pressure of 850 pounds per square foot. All of the divot ejections and trajectories were successfully recorded using a high-speed digital video system. The divot flight data supported the Return to Flight Shuttle Design Certification Review, one of the last engineering-review milestones prior to launch.

LIFT Project Manager Stephen Corda said objectives of the current F-15B flight tests included determining divot structural survivability and stability in flight and quantifying divot trajectories using videography. The flight data of divot trajectories also may be used for computational fluid dynamic code validation.

See F-15B, page 7

Griffin named NASA chief

Physicist Michael D. Griffin has been named to replace Sean O'Keefe as NASA administrator.

Griffin, 55, was nominated March 11 and confirmed by the U.S. Senate April 14. He is NASA's 11th administrator. O'Keefe left the administrator's post in February, after a three-year tenure, to become chancellor of Louisiana State University, Baton Rouge.

Michael D. Griffin

Prior to accepting the NASA post, Griffin was head of the space department at the Johns Hopkins University Applied Physics Laboratory in Laurel, Md. Griffin worked previously at NASA, as chief engineer and associate administrator for exploration, from 1991 to 1994 before moving on to posts in private industry, including those with Orbital Science Corp., Dulles, Va., and Computer Science Corp., El Segundo, Calif.

He also was president and chief operating officer of In-Q-Tel, a nonprofit investment organization sponsored by the Central Intelligence Agency. He served as deputy for technology at the Strategic Defense Initiative Organization and worked on federal missile defense system projects from 1986 to 1991.

In 2004 testimony before Congress, Griffin supported NASA's new space exploration initiatives, telling legislators that the Agency could expand exploration within its $16 billion budget by ending the Space Shuttle program early and reducing support of the International Space Station.

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Inside

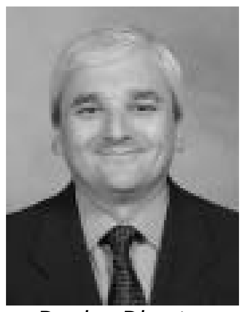
Center Director's column

Cultural Transformation

Dryden is beginning a focused process aimed at cultural transformation. This is a vital initiative. It grew out of Columbia Accident Investigation Board findings indicating that barriers to communication prevented effective response to critical safety information. Our own Fear-of-Reprisal survey and the Dryden responses to a survey conducted Agency-wide just over a year ago by outside consultants confirmed that similar barriers exist at Dryden.

While I am confident that no one at Dryden intentionally stifles communication of safety concerns, we must eliminate unconscious behaviors, mannerisms, attitudes and practices by our leadership that impede the sharing of information and issues, especially those relating to safety. That is the essence of the cultural transformation and an area where we all can improve.

I want to emphasize that cultural transformation will be a Dryden process. Although it is an Agency-wide initiative, here at the Center we will focus on issues specific to Dryden and will build on the many positive aspects of our culture. At the same time, we all must recognize the necessity of learning new and better ways to do our jobs. This is not something we can do overnight. It will take sustained commitment to learn from the process and change behaviors that don't support our core values.



Dryden Director Kevin L. Petersen

The cultural transformation process is already under way. An initial group of senior managers will soon be getting feedback on their behaviors from surveys completed by their subordinates, peers and supervisors. Based on that feedback, these managers will participate in workshops assessing survey results and then will help to develop behavioral action plans aimed at overcoming perceived weaknesses. They also will undergo training to learn how to make their behaviors truly reflect NASA and Dryden core values. They will learn their strengths as well as their weaknesses and will build upon strengths while learning to overcome weaknesses.

Meanwhile, the Dryden implementation team for the cultural transformation already has undergone training to facilitate the process. The team soon will participate in observation training. Once this training is complete, the team will conduct behavioral observations and offer feedback of observed behaviors to meeting participants as well as managers and supervisors. This summer, second and third groups of managers and observers will go through a similar process. During the course of this effort, the implementation team will gather anonymous data to track progress in promoting critical behaviors and to analyze reasons for undesired behaviors. The team will then design corrective action to address needs identified by the data.

Dryden is part of the second phase of NASA's cultural transformation effort. Centers examined in the first phase included Glenn, Johnson and Stennis. At these locations, there were skeptics about the processes. Once the effort was under way, however, many of the skeptics came to see real value in the cultural transformation process.

Besides removing barriers to communication, the transformation process will be focused on people skills in particular and leadership skills in general. It also will attempt to improve the levels of trust and respect between supervisors and employees.

I encourage everyone involved to participate enthusiastically in this endeavor, which will help us to strengthen our core values of safety, concern for people and commitment to excellence and integrity. It is complementary to our ongoing strategic planning and transformation efforts, and just another step in our quest to become a higher-performing organization.

NSBE honors Dryden engineer

By Beth Hagenauer
Dryden Public Affairs

The National Society of Black Engineers has honored Dryden aeronautical engineer Laurie Grindle with the 2005 Golden Torch Award for Outstanding Woman in Technology of the Year.

Grindle was selected because of her professional achievements in the fields of science and engineering. The Golden Torch Award honors "the best and brightest technology professionals in government, business and academia."

Grindle has participated in many flight research projects at Dryden, where she has been employed for the past 12 years. Most recently she served as chief engineer for the third flight of the X-43A hypersonic vehicle, in November 2004. This project validated supersonic-combustion ramjet (scramjet) propulsion technology, with the research aircraft sustaining hypersonic speeds nearing Mach 10, or almost 10 times the speed of sound.

Laurie Grindle

Prior to the X-43A project, Grindle was the principal investigator on the Advanced L-Probe Air Data Integration experiment flown on the Dryden's F-18 systems research aircraft. The experiment used air pressure to determine angles of attack and sideslip in addition to traditional airspeed and altitude measurements. Later, she was a researcher on the Supersonic Laminar Flow Control project on an F-16XL research aircraft, and also was involved in analysis of Space Shuttle maneuvers that resulted in expanding the Shuttle's aeronautical database.

Grindle began her NASA career in 1992 when she served an internship in the aerodynamics branch of Dryden's research engineering directorate. She accepted a permanent position at Dryden in 1993, following graduation from the University of California at Davis with mechanical and aeronautical engineering degrees. She earned an Engineer-in-Training license in 1994, and received a Master of Science degree in mechanical engineering from California State University at Fresno in 1998.

A private pilot with an instrument rating, Grindle said she chose to work at NASA because she was interested in space exploration, felt the Agency was always working on cutting-edge research and wanted to work in a field that would allow her to work with aircraft and spacecraft.

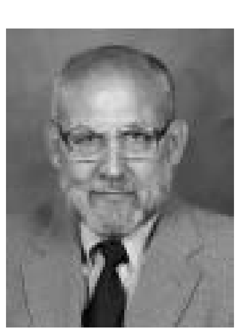
Grindle received her award March 24 at the 8th annual Golden Torch Awards ceremony in Boston during the National Society of Black Engineers 31st annual convention.

Dryden ombudsman named

When a significant issue or concern arises at Dryden that could impact mission success, safety or how an organization works, there is a place people can go for help or advice – the Dryden Ombudsman's office.

John "Dill" Hunley, who was Dryden's first chief historian and who established the Center's history program before his 2001 retirement, was recently appointed to the post. He replaces Vince Chacon, who remains an alternate ombudsman until a successor as alternate ombudsman can be named.

"I hope, as Dryden Ombudsman, to assist people in resolving their concerns through active listening, discussion of options and clarification of issues," Hunley said. "I will preserve people's confidentiality as long as there are no pressing concerns about safety or personal harm, and even then, I will discuss courses of action with the affected individual and arrive at a mutually acceptable course of action that will take care of the issue regarding safety or harm yet not infringe on anonymity if at all possible."



John "Dill" Hunley

Hunley added that he thought his background as Dryden's first chief historian would help in the work as ombudsman. Familiarity with the Dryden culture and with many of the people at the Center, he said, should help in efforts to create viable options in resolving concerns.

The ombudsman is intended as a neutral and impartial outlet where visitors' issues will be considered, free of bias and without favoritism or inappropriate advocacy. The ombudsman also is a confidential

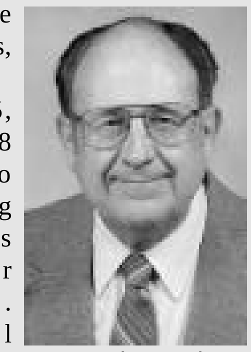
See Hunley, page 8

Reed dies at age 75

■ Noted aeronautics engineer mourned by NASA colleagues

By Alan Brown
Dryden News Chief

Robert Dale Reed, a distinguished NASA aeronautics researcher who pioneered lifting body and remotely piloted research aircraft programs at Dryden in the 1960s and 70s, has died.



Dale Reed

Reed, 75, died March 18 in San Diego after suffering complications from cancer treatment. Memorial observances were held at Edwards Air Force Base and William J. Fox Airfield, Lancaster, on March 30.

Although he worked on numerous aeronautical research programs during his nearly 52-year career at Dryden, Reed is best known for major contributions in the initiation and development of the lifting body and remotely piloted research vehicle programs.

Reed began his employment at Dryden – then known as the NACA (National Advisory Council on Aeronautics, NASA's predecessor) High Speed Flight Research Station – in 1953 following graduation from the University of Idaho with a degree in mechanical engineering. Throughout his long career at the Center, first as a civil servant and later as a contract engineer, Reed brought an outstanding degree of creativity to a variety of cutting-edge aeronautical concepts.

The lifting-body program grew out of Reed's confidence that a wingless, low lift-to-drag craft could serve as an orbiting vehicle equipped to re-enter Earth's atmosphere and land safely. In the lifting-body concept, the entire vehicle becomes a controllable airfoil, eliminating the need for wings. Although officials of the Apollo program had rejected the idea of a lifting body as the re-entry vehicle into the Earth's atmosphere as too risky and opted instead for a capsule, Reed had confidence that the lifting body concept would work. With backing from Paul Bikle, then director of the Flight Research Center (now Dryden), Reed was a prime mover in development of the prototype lightweight M2-F1 Lifting Body that flew successfully in 1963.

Success of the unpowered M2-F1 led to development of the rocket-powered lifting bodies, such as the M2-F2 and M2-F3, HL-10 and the Air Force X-24A and X-24B. Reed's lifting body research provided guidance for design of the Space Shuttle.

As manager of innovative programs, Reed's fascination with using model drone airplanes for flight research led to the Remotely Piloted Research Vehicle program. In place of the model aircraft operator's simple switch console, Reed substituted an actual ground-based cockpit containing all of the

See Reed, page 7

E 2889 NASA Photo

This image on the Dryden (then the NACA High-Speed Flight Research Station) ramp in 1953 shows, clockwise from bottom left, the Bell X-1A, D-558-1, XF-92A, X-5, D-885-2, X-4 and X-3, center.

NACA – 90 years later

Compiled by Peter Merlin
Dryden History Office

On March 3, NASA marked the 90th anniversary of the founding of its predecessor organization, the National Advisory Committee for Aeronautics, and the achievements of nearly a century of work in NASA's keystone discipline, aeronautics. For the past 90 years, the Agency has spearheaded advances in aeronautical technology that have found applications in nearly all civil, commercial and military aircraft since the NACA's founding.

From March 3, 1915, until its incorporation into NASA on Oct. 1, 1958, the NACA provided technical advice to the aviation industry in the U.S. and carried out cutting-edge aeronautics research. The NACA was created by President Woodrow Wilson in an effort to organize American aeronautical research and "to supervise and direct the scientific study of the problems of flight, with a view to their practical solution." NASA has continued this tradition to the present day.

EC95 43116-6 NASA Photo

This image shows the NACA Muroc staff from October 1947 in front of the NACA XS-1. In the background is the NACA JTB-29A that carried the XS-1 under its fuselage.

Major contributions

In the 1920s NACA engineers developed a low-drag, streamlined cowling for aircraft engines, which all aircraft manufacturers adopted. This innovation resulted in significant operating-cost savings and won the 1929 Collier Trophy. NACA engineers demonstrated the advantages of mounting engines into the leading edge of a wing of multiengine aircraft rather than suspending them below, another commercially adopted innovation.

During the 1930s, NACA engineers developed several families of airfoils. Many of these airfoil shapes have been successfully used over the years as wing and tail sections for general aviation and military aircraft, as well as propellers and helicopter rotors. The testing data gave aircraft manufacturers a wide selection of airfoils from which to choose. The information eventually found its way into the designs of many U.S. aircraft, including a number of important World War II-era aircraft.

In the 1940s, NACA researchers developed the laminar-flow airfoil, which solved the problem of turbulence at the wing trailing edge that had limited aircraft performance, and pioneered advances in transonic and supersonic flight. Engineer John Stack led development of a supersonic wind tunnel, speeding the advent of operational supersonic aircraft. He shared the Collier Trophy in 1947 with Army Air Force pilot Chuck Yeager and Lawrence Bell, of Bell Aircraft, for research to determine the physical laws affecting supersonic flight.

In 1945, Robert T. Jones, a premier aeronautical engineer of the twentieth century, formulated the swept-back wing concept to reduce shockwave effects at critical Mach numbers. Lewis Rodert received the Collier Trophy in 1947 from President Harry S. Truman for his pioneering research in a thermal ice prevention system for aircraft.

In December 1951, Richard T. Whitcomb verified his "area rule" in the NACA transonic wind tunnel located at the NACA's Langley Memorial Aeronautical Laboratory in Virginia. Useful in the design of delta-wing planes flying in the transonic or supersonic range, the rule resulted in the "Coke bottle" or "wasp waist" fuselage shape to reduce drag in the design of new supersonic aircraft.

In 1952, H. Julian Allen conceived the "blunt body concept," which suggested that a blunt shape would absorb only a very small fraction of the heat generated by the reentry of a body into Earth's atmosphere. The principle was later significant to intercontinental ballistic missile nose cones, the Mercury, Gemini and Apollo spacecraft and all unmanned probes entering Earth's atmosphere and that of other planets. In the 1960s and 1970s, lifting body research and flight tests proved the feasibility of that concept and contributed to design of the Space Shuttle.

See NACA, page 8

Air show set for October

The Edwards Air Force Base air show and open house will be held Oct. 22 and 23. Hours for the event will be 10 a.m. to 4 p.m. Parking and admission are free.

Base officials are finalizing show plans, but highlights are set to include the U.S. Army Golden Knights precision parachute team as well as a flyby by Brig. Gen. Chuck Yeager (Ret.) in a P-51 Mustang. Two Dryden F-18s will join Edwards aircraft in the opening air "parade" and the X-45 Unmanned Combat Aerial Vehicle will be among items on display in the base hangars.

Additional information about the event can be found at http://www.edwards.af.mil or by calling (661) 277-3510.

NASA Photo by Tom Tschida

Speed bumps help to make Dryden safer

The addition of speed bumps to the parking area near building 4800 remind Dryden personnel to slow down and proceed with caution when navigating their trips to and from work every day.

NASA Photo by Tom Tschida

Exchange events

The Dryden Exchange Council is sponsoring the following activities:

Pizza nights, at Round Table Pizza in Lancaster, also are being planned for July. Cost for each event is $10 per person, and includes one large two-topping pizza and choice of four sodas, one pitcher of beer or one carafe of wine.

Plans are currently under way for a trip to Dodger Stadium in July and a night at the Hollywood Bowl, featuring a fireworks display, in August. Tickets for the Dodger Stadium trip go on sale June 7 and for the Hollywood Bowl trip July 12. Additional details will be announced soon.

Tickets and information for all events may be obtained by calling the Dryden Gift Shop, ext. 2113, or Jessica Lux-Baumann, ext. 3820.

Odyssey insp

By Sarah Merlin
X-Press Assistant Editor

Dryden's Office of Academic Investments partnered with area corporate and government sponsors Feb. 11 to host the seventh annual Math and Science Odyssey, a daylong event designed to stimulate interest among middle schoolers in math- and science-based careers. About 175 students and 100 volunteers and presenters thronged workshops and Antelope Valley College hallways and ate hot-dog lunches, and didn't let rainy weather deter them from gathering in the college courtyard at day's end for a NASA F-18 flyover.

Workshop sessions led by engineers from Dryden, the Air Force Flight Test Center, academia and the aerospace industry kept students on the ball in their day away from the classroom. From "Cowabunga Chemistry" and "Juggling and Mathematics" to "So You Want to be a Pilot?" and "Origami in Geometry," students were given some real-life samples of what earning a living as an engineer might be like.

Dryden engineer Trong Bui and co-op student Carla Hernandez manned a booth dedicated to Bui's "Spike" aerospike rocket tests, conducted in Texas last spring. The photo display and an accompanying pressure-check device gave students a quick taste of what the test process involved.

"We just want to give them a little bit of exposure," said Bui, an engineer in Dryden's propulsion and performance branch. "Maybe there'll be a spark of interest for somebody – we hope we might be able to plant that."

Starr Ginn hosted "Shake, Rattle and Roll," a brief introduction to structural dynamics. Lockheed Martin ER-2 Life Support Lead Jim Sokolik gave students some hands-on experience with pressure suits and how they operate. And Dryden's Richard Wong was one of a three-man team leading engineering exercises for "Engineering as a Career: Try it Out!"

Wong and his AFFTC colleagues briefed their listeners – complete with PowerPoint charts – on flight test history, what it takes to be a pilot and on the career possibilities of computer-aided design, data gathering and analysis, designing and building structures and aircraft – and above all, the types of schooling such careers would require.

The Odyssey approach seemed to be working for at least two students, 13-year-old Katie Ellefson and Addison Greece, 14, both eighth graders at Hillview Middle School.

"Yeah, this is good," Ellefson proclaimed. "It's helping to learn about the different job opportunities available if you're good at math and science."

Less circumspect was 13-year-old Nathaniel Webber, from William Bradford Christian School in Tehachapi. Webber said he was interested in designing missiles and in "dropping stuff out the back of planes," adding that he was enjoying learning about the history of supersonic jets and stealth technology development.

Besides – attending the Odyssey had "sounded good," he said, and he thought it would be "better than regular school" for the day.

That appraisal was good enough for his dad, Chris Webber, workshop presenter for "How To Test Parachutes?"

"Mostly, I just want to help get the kids to understand what math and science are *good* for," said the elder Webber, an airdrop test engineer with the AFFTC's 418th Flight Test Squadron. "I want them to learn that those are abstract concepts that feed into real-world stuff."

Along with the F-18 simulator, Dryden's "NASA Mission Control" workshop, led by engineers Laurie Grindle and Jennifer Hansen, was a favorite among the day's offerings. With one of NASA's F-18's airborne over the college, students lined up to take a turn asking in-flight questions of pilot Craig Bomben.

"NASA One, this is NASA Odyssey," the questions began, after a brief lesson in the language and equipment required in aviation communications. Excited students then finished with a query about the plane's specs or operation or mission. A parent standing nearby said it best after watching one student's exchange with Bomben:

"This is so great that NASA will come here and do this," she said, her own level of enthusiasm apparent. "This kind of thing makes such a difference in stoking kids' dreams."

Bomben finished the day on a high note with a low-level flyby over the college courtyard, raising goose bumps and eliciting cheers as he left a red, white and blue streak across gray skies. Rain had required Odyssey organizers to re-tool some of the day's events, but hadn't dampened the spirits of the would-be pilots and engineers on the ground.

EC05 0042-10

Above, 13-year-old Rebecca Mittenthal tries her hand at landing an F-18 in Dryden's flight simu students at the Feb. 11 Math and Science Odyssey, held at Antelope Valley College, on how pr student group for her workshop on structural dynamics, "Shake, Rattle and Roll."

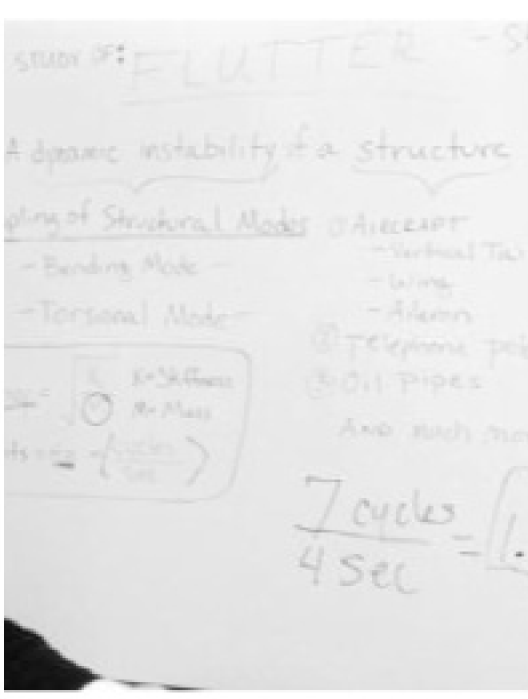
EC05 0042-16

ires students

NASA Photo by Tom Tschida

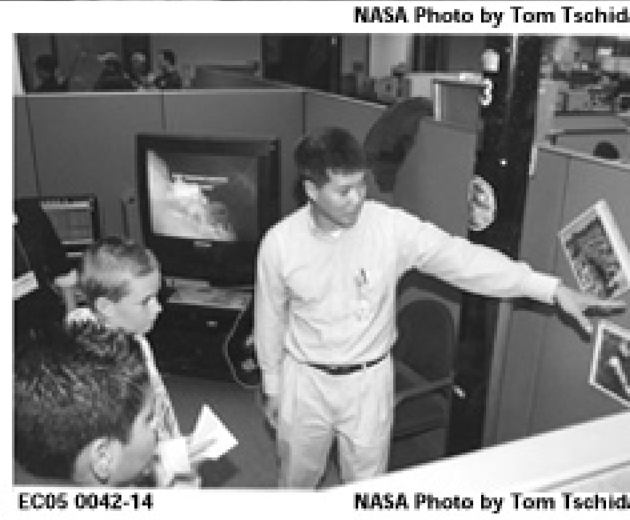
ockheed Martin ER-2 Life Support Lead Jim Sokolik, at right, briefs a group of suits work for pilots. Below, Dryden engineer Starr Ginn plays host to another

EC05 0042-21 NASA Photo by Tom Tschida



NASA Photo by Tom Tschida

EC05 0042-15 NASA Photo by Tom Tschida



EC05 0042-14 NASA Photo by Tom Tschida

EC05 0042-13 NASA Photo by Tom Tschida

Above left, engineer Jennifer Hansen leads a "NASA Mission Control" exercise, joined by Laurie Grindle and pilot Dick Ewers. Trong Bui, above right, gave Odyssey students a quick lesson in the aerospike rocket tests conducted last spring in Texas. One group of middle-school girls aced the competition, at left, in an engineering exercise aimed at using basic calculations to construct a container for holding marbles. Dryden's Richard Wong was one of a three-man team of workshop leaders that gave Odyssey participants a real-world look at careers in engineering with "Engineering as a Career: Try It Out!" Dryden staff partnered with area corporate and government sponsors to host the seventh annual Odyssey event, designed to stimulate interest among seventh and eighth graders in math- and science-based careers.

AAW phase 2 completed

By Alan Brown
Dryden News Chief

A flight research project that put a 21st century twist on century-old technology – a high-tech derivative of the Wright brothers' wing-warping method of controlling an aircraft's turning ability – can be summed up in two words: "It works!"

That was the conclusion of project manager Larry Myers as flight tests in the Active Aeroelastic Wing project at Dryden neared their end.

Jointly sponsored and managed by NASA, the U.S. Air Force Research Laboratory and Boeing's Phantom Works, the AAW project evaluated active control of lighter-weight flexible wings for improved maneuverability of high-performance military aircraft.

The second phase of AAW flights concluded in early March. These evaluated the ability of software in the aircraft's flight control computer to drive its modified control system so that aerodynamically induced twisting of the wings would provide roll control at transonic and supersonic speeds. An earlier phase of test flights, conducted in late 2002 and early 2003, provided baseline data on the flexibility of the modified wing prior to new control laws being developed and installed. In all, about 80 flights were flown in the project's two phases. A small number of follow-on flights to evaluate other control laws will be flown before the project concludes flight tests later this spring.

"We have demonstrated a number of subsonic and supersonic flight conditions where we have actually taken advantage of the aeroelasticity of the wing," Myers explained. "We've gotten excellent results, good agreement with predicted results (and) roll rates are comparable to what we predicted in simulation. It looks like we've proven the AAW concept."

"AAW represents a new philosophy for designing highly efficient wings in terms of structural weight, aerodynamic efficiency and control effectiveness," said Air Force AAW Program Manager Pete Flick, with the AFRL Air Vehicles Directorate at Wright-Patterson Air Force Base, Ohio.

AAW research flights demonstrated banking or rolling performance at transonic and supersonic speeds close to that of production F/A-18s due to wing aeroelastic effects alone, without using differential stabilator movements to assist in roll control and with smaller control-surface movements.

EC04 0361-10 NASA Photo by Carla Thomas

Phase 2 flight tests of the Active Aeroelastic Wing aircraft recently wrapped up at Dryden, validating the concept that active control of wing flexibility can control aircraft roll at transonic and supersonic speeds. The 21st-century AAW project incorporated century-old wing-warping technology pioneered by the Wright brothers.

"We defined 18 test points for this second phase of the flight test program," explained Dryden AAW project test pilot Dana Purifoy. "The test points started at 5,000 feet altitude and a speed of .85 Mach and went out to 25,000 feet and 1.3 Mach. "There were small variations on some points, but in general, we gained good knowledge about what kind of roll rates we expected to see."

Flick said the benefits of AAW depend on the specific application.

"With AAW, the control-surface deflections can be chosen to produce an aeroelastic shape that minimizes the load on the structure (resulting in reduced structural weight), minimizes the drag of the aircraft (improving fuel efficiency or range) or maximizes the maneuver rates of the aircraft (enhancing maneuverability)," he said.

Data obtained from flight tests will provide benchmark design criteria as guidance for a wide variety of future aircraft design concepts, ranging from high-performance fighters to high-altitude, long-endurance UAV concepts, large transport aircraft and high-speed, long-range aircraft.

The test aircraft – an F/A-18A obtained from the U.S. Navy – was modified with additional actuators to differentially control the split leading-edge flaps and thinner wing skins that allowed the outer wing panels to twist up to five degrees. The traditional wing control surfaces – trailing-edge ailerons and leading-edge flaps – were used to provide the aerodynamic force needed to twist or "warp" the wing.

Extensive instrumentation measured the twisting and bending of the wing during flight. Numerous strain gages were installed on both wings, along with a flight deflection measurement system incorporating an optical sensor package in a dorsal pod atop the fuselage and 16 infrared light-emitting diode markers on the upper surface of the left wing.

The F/A-18's modified wings underwent six months of structural loads testing in Dryden's Flight Loads Laboratory in 2001. The AAW F/A-18 then underwent extensive systems tests and simulation before flight tests began.

Once the flight test phase is successfully completed, Flick said researchers will turn their attention to spreading the AAW design philosophy to the technical community.

"Transitioning AAW will likely be a relatively long process since it represents a design philosophy," he said. "The application to future (aircraft) will depend on specific design requirements of those future systems. The benefits are greatest when a vehicle design is initiated with AAW in mind, and limited when applied to an existing vehicle."

March is a historically busy month at Dryden

March 31, 1947 – Douglas D-558-I (37970) arrived at Muroc Army Air Field.

March 27, 1952 – NACA research pilot Stanley P. Butchart made his first flight in the X-4 (46-677).

March 2, 1956 – The X-2 was towed onto Rogers Dry Lake for scenes in the motion picture *Toward The Unknown*.

March 9, 1956 – Capt. Joe B. Jordan flew NACA F-100A (52-5778) for scenes in the motion picture *Toward The Unknown*.

March 22, 1956 – After calling "No drop!" John "Jack" McKay was jettisoned along with the D-558-II (37974) when the P2B-1S (45-21787/84029/NACA 137) suffered a runaway prop on no. 4 engine. McKay jettisoned propellants and landed on the lakebed. The propeller on the mothership broke apart, slicing through the no. 3 engine and the fuselage, but Stan Butchart and Neil Armstrong landed the plane safely on the lakebed. Other P2B-1S crewmembers included: Joseph L. Tipton, Lester H. Booth, Norman K. Jones, Homer H. Hall and Thomas J. Raczkowski. Two chase planes, piloted by Capt. Loren W. Davis and Capt. Iven C. Kincheloe, accompanied the flight.

March 25, 1959 – First X-15 flight by a NACA pilot. Joseph A. Walker flew X-15 (56-6670) to an altitude of 48,630 feet and a speed of Mach 2 (1,320 mph).

March 12, 1962 – Milt Thompson piloted the first air-towed flight of the Paraglider Research Vehicle, Paresev 1 (N9765C).

March 14, 1962 – Bruce Peterson made his first NASA research flight. He was injured when the Paresev 1 (N9765C) crashed from an altitude of about 10 feet during a ground tow flight. Peterson's question after impact: "What happened to the lateral stick forces?"

March 26, 1962 – When Bill Dana landed F5D-1 (142350/NASA 213) on Grapevine Dry Lake, the aircraft sank into the soft clay surface of the lakebed.

March 29, 1971
– John A. Manke piloted the fastest X-24A flight, attaining a speed of Mach 1.6 (1,036 mph) and an altitude of 70,500 feet.

ECN 2059 NASA Photo

This 1968 image shows Dale Reed, second from left, with the radio-controlled mothership and models of the Hyper III and M2-F2 on the lakebed with Dryden research staff members.

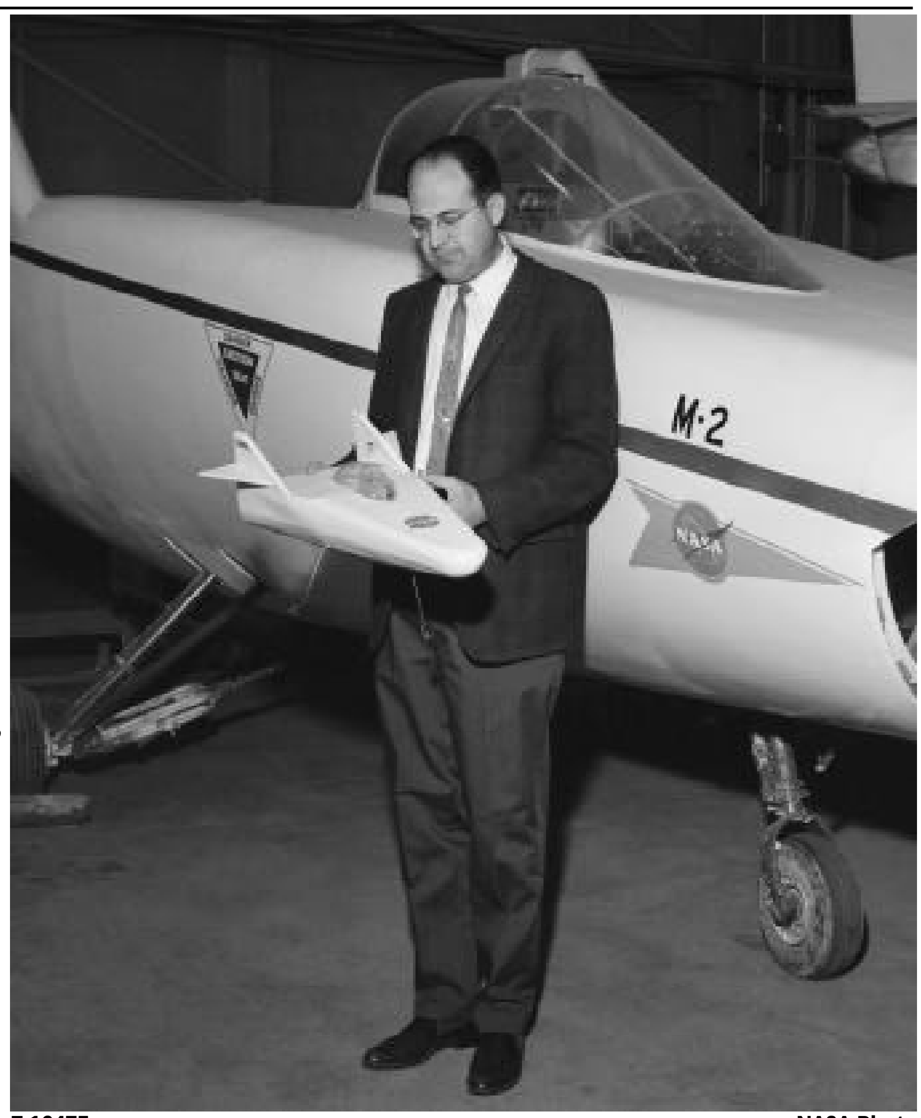
Reed ... from page 3

flight instruments and sensors of a fully equipped airplane. Reed tested his concept with the Hyper III, the first RPRV to have a test pilot fully in the loop, using a radio uplink. Reed carried the concept further with the PA-30 and three-eighth-scale F-l5, both of which saw the addition of a computer control system to be used in conjunction with the ground-based cockpit.

Reed held a patent for his 1977 invention of the Mini-Sniffer – a collapsible Mars exploratory airplane with hydrazine-fueled engine designed to ride aboard a Viking spacecraft and be remotely dropped to explore the Red Planet from low altitude. If used as Reed had envisioned, the craft would have performed aerial exploration until its fuel ran out, then landed at a desirable spot to continue feeding information back through the Viking Orbiter, in much the same fashion as the recently successful Mars rovers.

Early in his career, Reed was responsible for aerodynamics loads measurements on the early X-series research aircraft as well as aerodynamics heating measurements on the X-15 rocket plane. Reed also held a patent for his invention of a solar guidance system capable of steering an airplane by using the sun as reference. Later work included experiments in gyroless autopilots, deep-stall flight tests and free-flight airfoils.

Following retirement from NASA in 1985, Reed worked for Lockheed Advanced Development Projects for four years, managing design, development and flight test of various hypersonic and high-altitude aircraft concepts. He later returned to Dryden as a contract aerospace engineer, contributing his engineering expertise to the HyFlex, Apex and Spacecraft Autoland flight experiments. In recent years, Reed was employed part-time by Analytical Services and Materials Inc. at Dryden on a variety of projects, including the X-33, X-36 and X-38 research vehicles, two of which featured lifting body configurations, and the Beamed Laser Power Flight Demonstration in 2002 and 2003. In all, Reed managed 19 projects and designed a dozen aircraft during his career.



E 16475 NASA Photo

The image above, taken March 6, 1967, shows noted aerospace engineer Dale Reed, who died recently at age 75, holding a model of the M2-F1 lifting-body aircraft beside the full-scale M2-F1. Reed is credited with advocating for flight research with lifting-body aircraft. It was his belief, stated in his book "Wingless Flight," that without the solid flight-research confirmation of concepts pioneered by engineers at Langley Research Center, Hampton, Va., and Ames Research Center, Moffett Field, Calif., the lifting-body design would never be considered for use in design of a space vehicle. Reed's advocacy led to production of an entire family of research vehicles created for study of the lifting-body concept.

A member of the American Institute of Aeronautics and Astronautics, Reed wrote numerous technical reports and papers stemming from his work. He authored the book "Wingless Flight" on the lifting body flight research program, published by the NASA History Office in 1997 and republished later by University Press of Kentucky. Reed was awarded the NASA Exceptional Service Medal in 1967 for his work in initiating the lifting body research program, and was designated a Distinguished NASA Aeronautical Researcher by the Experimental Aircraft Association. He received AIAA awards for Outstanding Technical Paper in 1968 and Outstanding Technical Contributor in 1967. More recently, the Society of Flight Test Engineers presented its Clarence "Kelly" Johnson Award to Reed for his lifetime contributions to aeronautics.

Reed, who was a long-time Lancaster resident, is survived by his wife Donna and four children.

F-15B ... from page 1

"We're using the unique capabilities of the supersonic F-15B aircraft and the aerodynamic flight test fixture to provide a means to eject these debris or divots from the fixture, and then photograph them with a high-speed digital video system, where we're able to video the divots in flight at up to 10,000 frames per second," Corda explained.

NASA' s Space Shuttle Systems Engineering and Integration office at Johnson Space Center in Houston, Texas, funded the LIFT flight tests at Dryden. JSC aeroscience engineer Ricardo Machin said the LIFT flight tests will help validate models used for debris transport analysis.

"In particular, it's going to help us understand whether the divots break up once they come off the external tank, and secondly, whether they will trim and begin to fly or if they'll tumble. The difference between trimming and flying makes a huge difference in the amount of kinetic energy that this piece of debris can impart to the shuttle," Machin said.

The LIFT flight test required two new capabilities: an in-flight foam divot ejection system and a high-speed video system to track and record the trajectories of divots in flight. Dryden engineers developed both capabilities in just over two months.

Dryden's LIFT team designed, fabricated and ground-tested four divot ejection systems, completing 70 ground tests to determine and refine the best approach. Dryden engineers also designed and procured the very high-speed digital video equipment, including development of a system to synchronize cameras with the divot ejection system. In addition, they developed videography analysis techniques in order to quantify divot trajectories.

Staff at Marshall Space Flight Center, Huntsville, Ala., assisted Dryden researchers in the experiment and data obtained from the flights will be used in work at Ames Research Center, Moffett Field, Calif.

Marshall technicians sprayed aluminum sheets with BX-265 Space Shuttle foam for the F-15 LIFT tests. The aluminum sheets were reinforced with the foam, just as is done in preparing the Shuttle External Tank.

Ames researchers are using the information gained through the LIFT experiments to validate their three-dimensional computational fluid dynamics predictions of the divot stability and trajectories.

Administrator ... from page 1

"The United States will not abandon manned space flight," Griffin told the House Committee on Science. "Not to have the capability to fly humans in space, when other nations do and more will follow, is simply unacceptable for a great nation."

A native of Aberdeen, Md., Griffin earned a B.A. in physics from Johns Hopkins University and a Ph.D. in aerospace engineering from the University of Maryland. He also holds five master's degrees.

In April 2004, Griffin assumed his current post as head of the space department at the Hopkins Applied Physics Laboratory, where he had worked in the early 1980s. In 1986, he joined the Pentagon's "Star Wars" program, aimed at developing a missile defense shield.

NACA ... from page 3

In 1952, NACA laboratories began studying problems likely to be encountered in space. In May 1954, the NACA proposed to the Air Force development of a piloted research vehicle that would study the problems of flight in the upper atmosphere and at hypersonic speeds. That led to development of the famed rocket-propelled X-15 research airplane.

With the NACA's transformation into the National Aeronautics and Space Administration in 1958, research for space travel became a high-profile endeavor. NASA and Bell Aerosystems developed a Lunar Landing Training Vehicle flight simulator for the Apollo program that allowed a pilot to make a vertical landing on Earth in a simulated moon environment. Donald K. "Deke' Slayton, then NASA's astronaut chief, said there was no other way to simulate a moon landing except by flying the LLTV.

The Agency spearheaded development and testing of a Supercritical Wing designed by NASA aerodynamicist Richard Whitcomb. The SCW was designed to delay formation of and reduce the shock wave over a wing just below and above the speed of sound (transonic region of flight). The subsequent drag reduction resulted in increased cruising speed, improved fuel efficiency and greater flight range than can be attained by conventional-wing aircraft. As a result, supercritical wings are now commonplace on virtually every modern subsonic commercial transport.

NASA's F-8 Digital Fly-By-Wire flight research project validated the principal concepts of all-electric flight control systems. The F-8 DFBW system was the forerunner of current fly-by-wire systems used in the Space Shuttles and on nearly all modern high-performance military aircraft and in many civil transports, to make them safer, more maneuverable and more efficient. Electronic fly-by-wire systems replaced older hydraulic control systems, freeing designers to design aircraft with reduced in-flight stability.

NASA engineers developed and tested small, nearly vertical "winglets" designed by Whitcomb that are installed on an airplane's wing tips to help reduce drag. The winglet technology was initially applied to general aviation business jets, but has since been incorporated into most modern commercial and military transport jets.

In 2004, four decades of supersonic-combustion ramjet (scramjet) propulsion research culminated in two successful flights of the X-43A hypersonic technology demonstrator, attaining speeds of Mach 6.8 (5,000 mph) and Mach 9.6 (6,800 mph), world airspeed records for an aircraft powered by an air-breathing engine. This was the first time a scramjet-powered aircraft had flown freely under its own power, and proved that scramjet propulsion is a viable technology for powering future space-access vehicles and hypersonic aircraft.

The NACA and NASA have been involved in virtually all areas of aeronautics. Some of the Agency's other significant achievements include:

- The NACA proposed establishing a Bureau of Aeronautics in the Commerce Department, granting funds to the Weather Bureau to promote safety in aerial navigation, licensing of pilots, aircraft inspection and expansion of airmail.
- The NACA made recommendations to President Calvin Coolidge's Morrow Board in 1925 that led to passage of the Air Commerce Act of 1926, the first federal legislation regulating civil aeronautics.
- Research reports distributed by the NACA (and later NASA) served as the basis for many innovations later incorporated into American civil and military aircraft.
- In 1928, the NACA began operating the first refrigerated wind tunnel for research on prevention of icing of wings and propellers.
- NACA propulsion experts helped develop the field of gas turbine engine research and, to address continuing problems of how to cool turbine blades in the new turbojets, laid the basic foundation for research into heat-transfer phenomena.
- In the 1990s, NASA engineers developed a computer-assisted engine control system that enabled a pilot to land a plane safely when its normal control surfaces are disabled. The Propulsion-Controlled Aircraft system uses standard autopilot controls already present in the cockpit, together with new programming in the aircraft's flight control computers.

The Aero Centers

In 1917, the NACA established the Langley Memorial Aeronautical Laboratory in Virginia, now the NASA Langley Research Center. This laboratory quickly became the most advanced aeronautical test and experimentation facility in the world.

In 1939, NACA authorized establishment of an aircraft research laboratory at Moffett Naval Air Station near San Francisco. It was renamed Ames Aeronautical Laboratory for Joseph F. Ames, a chairman of NACA, in 1944, and eventually became NASA Ames Research Center.

In 1940, Congress authorized construction of an aircraft engine research laboratory in Cleveland. Dedicated in 1943, it was named the Lewis Research Center in 1948, after George Lewis, former NACA director of aeronautical research. Today, it is known as NASA Glenn Research Center at Lewis Field, in honor of former astronaut and U.S. Senator John Glenn.

A temporary Langley outpost established at Muroc Army Air Base, Calif., in 1946 shortly became a permanent facility known as the NACA Muroc Flight Test Unit. In 1949, it became the NACA High Speed Flight Research Station and in 1954 became independent from Langley. In 1976, it was renamed the Dryden Flight Research Center in honor of Dr. Hugh L. Dryden, the last director of the NACA and the first deputy administrator of NASA.

The Next 90 Years

In the future, NASA will continue to develop and validate high-value technologies that enable exploration and discovery while continuing its legacy breakthrough work in aeronautics.

The agency's aeronautics research mission directorate is focused on improved airspace management systems, technologies to improve safety and security of commercial air travel and revolutionary vehicle designs with significantly greater performance, lower operating costs and lesser environmental impacts.

Hunley ... from page 2

resource prohibited from disclosing a visit or call without the permission of the person involved, except in cases where withholding such information could lead to harm or conflict with existing laws.

The ombudsman is required, however, to bring forward information about cases involving imminent risk of serious harm, violations of federal law, fraud, waste or mismanagement. The ombudsman answers to the Center Director and is authorized to talk with any appropriate NASA official in efforts to resolve problems in a non-adversarial way. In all cases, the ombudsman will discuss such action with the affected individual before talking with others.

In order to carry out this work, the ombudsman can meet at a location suggested by the individual bringing an issue forward and will candidly discuss concerns and offer non-judgmental and supportive listening. The ombudsman also can help coach people to negotiate and independently resolve problems, understand a conflict from multiple perspectives, identify the problem's roots, develop strategies for resolving the issue, obtain information to ensure an unbiased perspective, provide information and facilitate solutions.

The ombudsman is not an avenue for reporting a hazard or close call. For those issues, personnel should utilize the Close Calls/Hazard Reporting System using DFRC Form 127 or should call ext. 2307. The ombudsman's focus is on concerns with management practices, policies or procedures or issues that require sensitivity.

The new office also does not replace existing channels for voicing concerns; the ombudsman will direct people to appropriate outlets such as Human Resources, the Employee Assistance Program or Equal Employment Opportunity, when necessary. The post of ombudsman was created to address concerns that do not fall into the purview of established channels. Where appropriate, the ombudsman will offer these channels as options, but in all cases not involving safety, imminent harm or breaches of law, it will be up to the individual bringing forward a concern to decide which option to pursue.

"The effectiveness of the ombudsman rests on a reputation for fairness, objectivity, tact and respectful concern for the welfare of individuals and the well-being of Dryden as a whole," Hunley said. "The ombudsman does not serve as an advocate but strives to promote fairness and justice."

Assigning an ombudsman at each NASA center was a recommendation of the Agency-wide Action Team headed by Al Diaz, now NASA's associate administrator for the science mission directorate. The idea was to provide civil servants, students and contractors with a supplemental, informal and confidential avenue for communications so significant issues and concerns about safety, mission success or performance could be raised.

Hunley taught history at Allegheny College, Meadville, Pa., for five years before becoming first an Air Force historian and then a historian at NASA Headquarters. Following retirement from the Center, Hunley was a Ramsey Fellow at the Smithsonian National Air and Space Museum for one year, where he completed research on the history of American rocketry. He continues work on a book based on that research. He has authored or edited numerous books and articles on the history of aeronautics and German history, including "The Birth of NASA: The Diary of T. Keith Glennan" (NASA SP-4105), "The Life and Thought of Friedrich Engels: A Reinterpretation of his Life and Thought" (Yale University Press) and "Toward Mach 2: The Douglas D-558 Program" (NASA SP-4222).

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